2018 Schutter Diagnostic Laboratory Annual Report- Summary

The Schutter Diagnostic Laboratory (SDL) at Montana State University (MSU) is provided as a service to the citizens of Montana for plant pest identification and integrated pest management education. In 2018, the SDL conducted 3,223 plant, plant disease, insect, mushroom, and abiotic diagnoses in 52 Montana counties and three additional states.

- Over $7.5 million was saved affecting approximately 408,000 acres as a result of SDL recommendations.
- 86% of the survey respondents thought the SDL services were very useful in solving plant or arthropod-related problems.
- 90% of the survey respondents thought the timeliness of response was good or excellent.
- 70% of the survey respondents in the survey said the diagnoses from the Schutter Diagnostic Lab influenced their management decisions.

**Results of 2018 client surveys, n=168* *Data from "Schutter Diagnostic Lab Surveys" compiled by MSU HELPS Lab, 2018.

Impacts and Outcomes

- We received specimens suspected of being high priority noxious weeds that were not. Two specimens suspected to be priority 1A noxious weed common reed were submitted to the lab and were identified as the native subspecies (*P. australis* spp. americanus).
- One respondent to a phone survey claimed that $6 million was saved ($63/a) as a result of a sample submitted to the diagnostic lab.
- We identified several samples of the emerging invasive annual grass *Ventenata dubia*, including a first report for one Montana county.
- First time reported in the state for the following insects and other arthropods: the Gulf coast tick, *Amblyomma maculatum*; the banded ash borer, *Neoclytus caprea*; and the small hive beetle, *Aethina tumida.*
- Spider outreach and education has been effective, as samples decreased by 51% from 2015-2018.
- For several samples submitted from agricultural land, identification of non-damaging organisms were made, including potworms, proturans, and meadow plant bugs on alfalfa, averting unnecessary crop treatments.
- We processed several samples of berries that clients had used to make jam without first knowing the identity of the berries. In some cases, toxic berries were used in the jam and we advised clients not to consume it.

Quotes from clients

- "Valuable to me otherwise I would be spending money on treatments that wouldn't be effective, educational to know you're doing the right treatment."
- "We often times need timely responses and they are excellent in helping us in reaching deadlines. Without Schutter we don't have another lab."
- "I am so grateful to be able to access this valuable service. The grass identification allowed me to use native grass seed collected from my property without risk of planting a weedy species."
- "It's the only option a home owner has for disease identification."
- "The lab helps us help our growers make better agronomy decisions."
- "Schutter lab is an essential part of our IPM tools."

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Introduction

Montana State University (MSU) and MSU Extension provide plant pest identification through the Schutter Diagnostic Laboratory (SDL). The mission of the SDL is to provide the citizens of Montana with the highest quality diagnostic laboratory support. The SDL safeguards Montana agriculture, landscapes and public spaces from plant pests by offering identification services, management advice, and education. Our recommendations are based on integrated pest management (IPM) principles, which is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic and environmental risks. The mission of the SDL also includes the early detection of new and invasive pests that may pose a risk to Montana and to the U.S. to prevent significant limitations to agricultural production and international trade.

In 2018, the SDL conducted a total of 3,223 plant disease, insect/other arthropod, plant, mushroom, herbicide injury, and other abiotic disorders diagnoses through physical, email, and APP (Plant Sample Submission App) samples (Table 1).

Table 1. Number of diagnoses by the Schutter Lab in 2018.

	Number of Diagnoses
Plant Disease	1,167
Insects & Other Arthropods	865
Plant & Mushroom ID	689
Herbicide Injury	150
Other Abiotic Disorders	352
Total	**3,223**

Samples were received from 52 counties in Montana (Table 2) and three additional states-North Dakota, Wyoming, and Oklahoma. The greatest number of diagnoses were in Gallatin, Ravalli, Lewis and Clark, Beaverhead, and Teton Counties in 2018. For samples submitted by county Extension offices, the counties with the highest number of diagnoses were Ravalli, Gallatin, Hill, Beaverhead, and Teton (Table 3).

Table 2. Total number of diagnoses by county in 2018.

Gallatin	569	Judith Basin	41	Richland	17
Ravalli	194	Big Horn	37	Lincoln	16
Hill	161	Missoula	37	Valley	16
Lewis and Clark	130	Glacier	37	Phillips	14
Teton	100	Roosevelt	36	McCone	14
Yellowstone	100	Silver Bow	35	Meagher	13
Beaverhead	99	Carbon	34	Dawson	12
Chouteau	94	Broadwater	33	Jefferson	11
Cascade	83	Stillwater	32	Powell	11
Park	80	Daniels	31	Fallon	5
Sheridan	72	Toole	26	Carter	5
Pondera	72	Sweet Grass	25	Wibaux	5
Fergus	71	Deer Lodge	23	Musselshell	4
Sanders	70	Rosebud	22	Wheatland	2
Liberty	60	Custer	21	Treasure	1
Flathead	59	Blaine	19	Granite	1
Lake	57	Powder River	18		
Madison	47	Garfield	17		

Table 3. Number of diagnoses for county Extension offices (52 total) in 2018.

Ravalli	177	Broadwater	28	Prairie	9
Gallatin	146	Missoula	27	McCone	8
Hill	112	Cascade	25	Powell	8
Beaverhead	93	Deer Lodge	24	Mineral	7
Teton	77	Stillwater	23	Roosevelt	6
Lewis And Clark	68	Carbon	22	Fallon	5
Sanders	68	Madison	21	Flathead	5
Chouteau	64	Sweet Grass	20	Wibaux	5
Park	64	Rosebud	19	Jefferson	4
Pondera	56	Custer	16	Musselshell	4
Yellowstone	55	Powder River	16	Phillips	4
Liberty	53	Toole	16	Richland	4
Fergus	51	Garfield	15	Carter	3
Big Horn	36	Daniels	14	Wheatland	2
Judith Basin	36	Silver Bow	13	Dawson	2
Sheridan	34	Blaine	13	Granite	1
Lake	31	Valley	13		
Glacier	30	Meagher	10		

In addition to diagnostic services, SDL diagnosticians provided outreach, research, and educational materials about pests of concern to clients in Montana. The SDL maintains a Facebook page that has over 400 users. In 2018, we had a post reach of over 35,000 from our total of 115 Facebook posts, and an average of 25 engaged users per post. Our posts usually focus on timely information about plant diseases, insects, and plant identification for our wide range of clientele. We also send out Urban Alerts (https://mturbanalert.org) and AgAlerts (https://mtagalert.org) that are managed by the Schutter Lab at MSU Extension to inform our clientele on trends and pertinent diagnostic issues statewide. The MSU Urban Alert system (401 subscribers) is intended for Extension agents, landscape professionals, arborists, city foresters/managers, and any other client concerned with ornamental plants and vegetables. The MSU AgAlert system provides current and research-based information for Montana agricultural clients. There are currently 1,092 email, 108 text, and 13 fax subscribers. There were 43 AgAlerts posted in 2018. There were 3,868 users with an average of 2.08 sessions per user.

In 2018, we beta-tested an APP called the “Plant Sample Submission APP” for an additional way to receive samples. Users found the APP easy to use (84% of those surveyed). Instructions on how to download and use the APP can be found here http://www.diagnostics.montana.edu/sample_submission_app.html.

2018 Plant Disease Summary

Diagnostic Staff:
Dr. Mary Burrows, Extension Plant Pathologist & Montana IPM Coordinator
Dr. Eva Grimme, Plant Disease Diagnostician & Associate Extension Specialist

Other Assistants/Specialists:
Dr. Mareike Johnston, Plant Pathologist
Dr. Cathy Cripps, Mycologist
Dr. Barry Jacobsen, Plant Pathologist
Toby Day, Extension Horticulture Specialist
Sarah Eilers, IPM Manager
Chance Noffsinger, Research Assistant

Impacts & Outcomes

- One respondent to a phone survey claimed that $6 million was saved ($63/a) as a result of a sample submitted to the diagnostic lab. They said they valued the work the lab does "Most critical thing the lab does; it's a place where they can see a pattern first, if there is a new disease in Montana, they can identify it and treat it quickly."
- The timely response and correct diagnosis of the diagnostic team ensures that unnecessary treatments are avoided and integrated pest management strategies are applied to address pest problems.
- "Being able to have a quick and accurate identification/diagnosis makes MSU Extension look great! It encourages people to return to our offices with future problems and utilize our services. It also shows that MSU Extension is a responsive, effective, and accurate educational resource. Clients really appreciate that the lab provides not only conventional management methods but integrated approaches to mitigate pest populations and reduce re-occurrence. It's nice to be able to provide the client with more than one option for controlling the pest."

Trends from 2018

Of 1,167 disease diagnoses in the Schutter Diagnostic Laboratory, 459 were field crops. The most frequently submitted crops were cereals (67 winter wheat, 53 barley, 34 spring wheat, 19 durum wheat, 7 mixed), pulses (78 chickpea, 36 lentil, 17 dry pea). Root rots, in particular Fusarium and Rhizoctonia, were common in cereals and pulses. Aphanomyces root rot was identified in two counties in Northeastern Montana on lentil. Minor crops including sainfoin, quinoa, and chia were also submitted.

The SDL received a high number of apple and crabapple tree samples with fire blight and bacterial blight as the dominant diseases. The long and cold winter affected most fruit trees which showed symptoms of frost damage.

In early summer, an unusual amount of raspberry samples were submitted. Following investigation, the plants were not affected by disease but by environmental/cultural factors like frost or nutrient deficiency.

Throughout the year, evergreen samples, especially Colorado blue spruce, were submitted with symptoms of Rhizosphaera needle cast disease, Stigmina needle cast disease or sudden needle drop. Pine trees were affected by Dothistroma needle blight.

In late summer, Marssonina leaf spot was evident on aspen, poplar and cottonwood trees (Table A1, Appendix). Rust diseases on serviceberry and hawthorne were a common occurrence in 2018.

Sample Summary

In 2018, the SDL made 1,167 plant disease and 352 abiotic disorder diagnoses (Table 4).

Table 4. Numbers of agriculture, horticulture and abiotic diagnoses in 2018.

	# Diagnoses
Agriculture	459
Horticulture	708
Abiotic	352
Total	1,519

Samples were mainly submitted by extension personnel (57.1%) with 48.8% from non-commercial and 8.3% from commercial entities. Commercial entities outside of MSU accounted for 26.7 % of the samples. The number of non-extension, non-commercial samples accounted for 15.7%. The highest number of samples came from homeowners/gardeners (32.4%), agribusiness (12.9%), growers/farmers (12.4%) and arborists (6.1%). Other submitters include crop consultants, companies, regulatory agents, and lawn care professionals.

Of the submitted samples, deciduous and evergreen woody ornamentals accounted for 35% of the total disease samples submitted to the SDL. Sample hosts of this category included apple, crabapple, Colorado blue spruce, green ash, maple, aspen and pine trees. Field crops like chickpea, lentils, dry peas and small grains like wheat and barley accounted for 26.2% of disease samples. Fruit and vegetable samples (apple, raspberry, tomato, and cucumber) accounted for 16.7% and turf samples accounted for 3.7% of the samples.

Certifications

Dr. Grimme completed the Plum Pox Virus ELISA proficiency test and continued as a USDA/APHIS PPQ certified diagnostician to screen for PPV. We continue to assist the Montana Department of Agriculture CAPS surveys. Plum Pox Virus (PPV) is a federally regulated virus of fruit trees.

2018 Insect Diagnostics Summary

Diagnostic Staff:

Laurie Kerzicnik, Associate Extension Specialist/Urban Arthropod Diagnostician
Ruth O'Neill, Research Associate, Wanner Lab & Cropland Insect Diagnostician

Other Assistants/Specialists:

Toby Day, *Horticulture Specialist,* MSU
Dr. Michael Ivie, *Systematic Entomologist,* MSU
Dr. Justin Runyon, *Entomologist,* US Forest Service
Dr. Casey Delphia, *Research Associate/Entomologist,* MSU
Dr. Thomas Schwan, *Rocky Mountain Laboratories*

Impacts & Outcomes

- First report of the Gulf coast tick, *Amblyomma maculatum*, in Montana; *Dec 2018*
- First report of the banded ash borer, *Neoclytus caprea*, in Montana (on ash firewood in Fort Peck, MT); *Apr 2018*
- First report of the small hive beetle, *Aethina tumida*, from honey bee hives in Montana (in Gallatin County) (came in through Schutter and was confirmed by Frank Etzler (grad student at MSU) and Dr. James Ellis (University of Florida)); *May 2018*
- New county records for the following:
  - *Prionus imbricornis* (Coleoptera: Cerambycidae); Custer County (submitted by Elin Kittelmann, Extension Agent); *Jul 2018*
  - *Drosophila suzukii* (Diptera: Drosophilidae); Missoula, Ravalli, Gallatin Counties (submitted by Sandy Perrin, Katrina Mendrey, Laurie Kerzicnik); *Jul 2018*
  - *Monochamus clamator* (Coleoptera: Cerambycidae); Big Horn County (submitted by Molly Hammond, Extension Agent); *Oct 2018*
  - *Agromyza frontella* (Diptera: Agromyzidae); Park County; *Aug 2018*
- Spider outreach and education has been effective, as spider sample submissions decreased by 51% from 2015-2018.
- Carpenter ants, garden millipedes, and earwigs were identified and confirmed for four suspected termite cases, preventing unnecessary treatment costs for termites.
- For several samples submitted from agricultural land, identification of non-damaging organisms were made, including potworms, proturans, and meadow plant bugs in alfalfa (probably collected from grassy weeds), averting unnecessary crop treatments.
- For five cases of "suspected bed bugs," other insects/arthropods were confirmed, eliminating an unnecessary need for costly bed bug treatments.
- Insect identifications helped to protect several important artifacts in museums across the state, including books, textiles, Native American artifacts, repositories for Western artists, and contemporary art.
- Two ticks were identified, *Dermacentor albipictus* and *Dermacentor* sp., and clients were assured that they did not have ticks that vectored Lyme disease.

Trends from 2018

- The western sculptured pine borer, *Chalcophora angulicollis* (Fig. 1), had significant activity in late May statewide. It is one of the largest flatheaded borers (jewel beetles/metallic wood borers) found in the western US. The upper surface of this beetle is marked with sculptured areas. They take flight and make quite a bit of noise, sounding like an airplane. They infest injured and dead pines, firs, and Douglas-fir.

Figure 1. ***Chalcophora*** **sp. adult, 22-31mm.** *Photo by Mat Walter.*

- The pale-striped flea beetle, *Systena blanda*, (Fig. 2) was reported in unusually high numbers on forage alfalfa in Custer County. This is a small, shiny beetle with a pale longitudinal stripe on each wing cover. It is probably widespread in Montana, but it is normally only present at very low numbers. They chew numerous small holes in alfalfa leaves, usually near the base of the leaf.

Figure 2. Pale-striped flea beetle on alfalfa.

- An outbreak of a seed bug, the false chinch bug, *Nysius* sp. (Fig. 3), occurred as a home invader in several counties in the fall. These seed bugs are coming to buildings and turfgrass in search of moisture and humidity when their normal host plants dry out. When not aggregating on buildings, they are sap-feeding insects and feed on weeds such as flixweed, plants in the mustard family, turf, kochia, and pigweed. Aggregations can be in the hundreds at certain times on plants and on buildings. Their invasion is only temporary, and they typically die in about a week.

Figure 3. False chinch bug adult (left) and nymph or immature (right). ***Photo by Salvador Vitanza.***

- Western yellowjacket populations were higher than usual, prompting several calls, emails, and samples in late summer.

- Pear slugs/sawflies were common on cotoneaster, creating a “skeletonized” look on the leaves.

Figure 4. Pear leaf blister mite.

- Blister mites (Fig. 4), which are a type of microscopic mite called an eriophyid mite, caused extensive cosmetic damage on pear and apple trees.

- The aspen blotch leafminer, *Phyllonorycter* sp., (Fig. 5) is a moth that infests cottonwoods, poplars, and aspen leaves, causing leaf blotches and necrotic spots. Damage is usually considered cosmetic, but sometimes heavy outbreaks can cause reduced tree growth, branch dieback, and top-kill (but generally rare for this to happen). The leafminers attack stressed trees.

Figure 5. Aspen blotch leafminer, *Phyllonorycter* sp.

- Several samples and reports of carpenterworms (Lepidoptera: Family Cossidae) (Fig. 6) occurred in 2018. They are pests of ash, cottonwoods, poplars, aspens, elm, birch, oak, and other hardwoods, infesting stressed, older, and dying trees, particularly cottonwoods in shelterbelts.

Figure 6. Carpenterworm in cottonwood.

- The Parson spider was commonly found statewide throughout the year while the hobo spider was found invading homes in western and central Montana from August through November.

- Several species of carpet beetles and ants were submitted for diagnosis from inside the home in the spring and summer.

- Springtail home infestations are increasing in the last couple of years as well as the spotted snake millipede in several areas of the yard (but particularly in strawberries and potatoes).

Noteworthy samples

- In June of 2018, a tarantula (Fig. 7) was found at a local gas station in Forsyth. It was dead and lying in the grass in the back of the store. It was likely transported from an area where tarantulas are native (not in Montana). It is most likely a species of *Aphonopelma*.

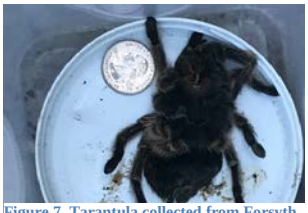

Figure 7. Tarantula collected from Forsyth, MT at a local gas station.

- The black witch, *Ascalapha odorata* (Family Noctuidae) (Fig. 8), was found in the Medicine Lake area of Sheridan County. This is one of the largest noctuid moths found in North America. It ranges through the lowlands of tropical America, where it is a resident. It is brought northward during the summer monsoons and appears as far north as Anchorage, Alaska. It is often found in garages, bridges, or under eaves.

Figure 8. Black witch moth.

- On August 2, 2018, in irrigated alfalfa growing adjacent to the Yellowstone River in Park County, foliage samples infested with a high numbers of the larvae of the alfalfa blotch leafmining fly, *Agromyza frontella,* were collected. Damage was throughout the field. This is the second reported incidence of this pest in Montana. The first infestation was observed in Lewis and Clark County in August 2017.

Sample Summary

In 2018, 865 arthropod diagnoses were completed (Table 5). Of these identifications, 8% were spiders and 92% were insects or other arthropods.

Table 5. Numbers of insect, spider, and other arthropod diagnoses in 2018.

	# Identifications
Insects/Mites/Other Arthropods (excluding spiders)	797
Spiders	68
Total	865

Of the samples submitted, field crops and seed crops accounted for 6% of the samples submitted. Samples from field crops and forages included: Chick pea (western flower thrips), lentils (pea leaf weevil, thrips), alfalfa (pale-striped flea beetle, clover root curculio, alfalfa weevil, alfalfa blotch leafminer, *Lygus* bug, pea aphid, unidentified leafhoppers, cutworm damage), wheat (wheat stem maggot, Bank's grass mite, cereal leaf beetle, false chinch bug), oats (wireworm), sweet corn (corn blotch leafminer), crested wheat (*Labops* black grass bug), safflower (*Lygus* bug, thrips), and quinoa (*Melanotrichus coagulatus* plant bug, wireworm). Two beetle species were identified from stored barley in grain bins, the lesser grain borer and the red flour beetle.

The other 94% of the samples were submitted from trees, shrubs, vegetables, turfgrass, greenhouses, and households. The greatest number of **tree/bush samples** came from apple, arborvitae, ash, aspen, cottonwood, poplar, birch, boxelder, cherry, cotoneaster, dogwood, Douglas-fir, elm, fir, hackberry, honeylocust, linden, lilac, maple, mountain ash, oak, pine, plum, pear, spruce, viburnum, and willow (Table A1). The **vegetable hosts** consisted of basil, beans, beets, chard, corn, cumber, peppers, potatoes, squash, and tomatoes. Some of the common pests on these hosts included aphids, beet leafminers, flea beetles, spider mites, and thrips. In the **greenhouse**, thrips, spider mites, and springtails were common. Most of the greenhouse hosts were tomatoes and basil.

For **households**, a series of home-invading insects were identified (16% of the total diagnoses; this doesn't include spiders). A lygaeid seed bug (*Nysius* sp.) was frequently reported statewide in the fall. The elm seed bug, *Arocatus melanocephalus*, was not as prevalent this year but appeared in households in the spring and the fall. The Western conifer seed bug was common in the fall on several buildings and in homes. Two small invasive root weevils, *Cathormiocerus spinosus* and *Romauldis bifoveolatus*, were common in addition to two other larger weevils, the strawberry root weevil and the black vine root weevil. Carpet beetles were submitted in the spring and the summer with concern over

control and new infestations. Bed bugs samples were submitted from several counties, suggesting a further need for awareness and prevention throughout the state.

Spider awareness and outreach have effectively reached many individuals, as spider submissions to the Schutter Diagnostic Lab have decreased by 51% since 2015. Spider samples constituted 35% of the home samples submitted. Of these samples, 13% were submitted for concerns about the hobo spider and whether it is harmful to humans. These diagnoses were followed with reports, which allowed for many clarifications of misinformation about spiders, particularly about the hobo spider and the brown recluse.

2018 Weeds Lab Diagnostic Summary

Diagnostic Staff:

Noelle Orloff, Associate Extension Specialist

Other Assistants/Specialists:

Dr. Cathy Cripps, Mycologist
Dr. Jane Mangold, Rangeland Invasive Plant Specialist
Dr. Tim Siepel, Cropland Weed Specialist

Impacts & Outcomes

- Accurate plant identification is critical in assessing plant toxicity, and we assisted clients with poisonous plant issues in 2018. For example, this year we processed several samples of berries that clients had used to make jam without first knowing the identity of the berries. In some cases toxic berries were used in the jam and we advised clients not to consume it.
- Our services provide an essential resource for first detectors of high priority pests. For example, in 2018 we identified several samples of emerging invasive annual grass *Ventenata dubia*, including a first report for one Montana county. We also led five interactive trainings that included information about identification of this pest.
- Accurate identification can prevent controlling plants that are not pests. For example, we received specimens suspected of being high priority noxious weeds that were not. Two specimens suspected to be priority 1A noxious weed common reed were submitted to the lab and were identified as the native subspecies (*P. australis* spp. americanus).

Plant Identification Activities and Trends

In 2018, the SDL processed 345 physical specimens for plant identification, and about 300 electronic samples (i.e. photos in emails, texts, and through our sample submission app). These sample numbers are 17% higher than those observed in 2017.

Most samples came from noncommercial sources such as government personnel, homeowners, and small acreage landowners. These samples accounted for 80% of sample submissions. Noncommercial samples are typically from residential or small acreage landowners who need information on how to control a plant in their management area or in gardens or small pastures. Samples from commercial clients such as farmers, ranchers, consultants, nurseries, and representatives from agribusinesses accounted for 20% of all submissions.

The 345 physical samples submitted represented 230 unique species. Fifty percent of these samples were exotic plants. The most commonly submitted exotic species were roving bellflower (*Campanula rapunculoides,* 8), cutleaf vipergrass (*Scorzonera laciniata,* 6), and ventenata (*Ventenata dubia*, 5). Thirty two percent of physical samples were native plants. The most common native species were Douglas's knotweed (*Polygonum douglasii*, 4) and western aster (*Symphyotrichum ascendens*, 4). Slender wheatgrass (*Agropyron trachycaulus*) and serviceberry (*Amelanchier alnifolia*) each had three submissions.

Three confirmed specimens of state-listed noxious weeds were submitted (Table 6). We also received specimens suspected of being high priority noxious weeds that were not. For example, two specimens suspected to be common reed were submitted to the lab and were identified as the native subspecies (*P. australis* spp. *americanus*). The SDL provides a valuable resource where land managers

can get accurate information about suspected problematic plants such as these high priority noxious weeds.

Table 6. State listed noxious weeds and regulated plants submitted to the SDL in 2018.

Species	County	Priority
Oxeye daisy	Judith Basin	2B
St. Johnswort	Sanders	2B
Sulfur cinquefoil	Sanders	2B

Mushroom Identification Activities

In addition to plants we also identify mushroom specimens. In 2018 Dr. Cathy Cripps assisted the SDL by identifying 44 mushroom samples. These specimens were of 30 different species. Ninety seven percent of these samples were from noncommercial sources, and were found in mainly lawns, gardens, or natural areas. Clients are often interested in edibility or toxicity of mushrooms, and proper identification is vital for these types of questions.

Herbicide Injury Activities and Trends

We assessed over 115 physical samples for potential herbicide injury along with about 35 electronically submitted samples. This number is a 30% increase compared to 2017. Of these, 35% were submitted from an agricultural setting, while 65% were submitted from urban or residential settings. We suspected herbicide injury to be affecting samples in 85% of these cases.

Of the 42 commercial agricultural samples we assessed for herbicide injury, the largest percentage was the six pulse crop samples we suspected were affected by herbicide carryover. This number decreased since last year, when we received 15 pulse crop sample with symptoms consistent with this issue. We also recorded several cases where symptoms were consistent with herbicide injury from in-crop applications of herbicide that resulted from situations such as mistakes in tank mixes and interactions between weather events and herbicide applications. There were a range of other issues suspected including herbicide drift.

The other main group of herbicide injury cases was those in turf and ornamental settings, where we assessed 58 samples for herbicide injury symptoms. Of these, 39 woody ornamentals showed symptoms consistent with synthetic auxin herbicide injury. These symptoms could have arisen due to situations like herbicide drift from lawn applications. In nine cases we were able to pinpoint the likely cause of synthetic auxin injury to vegetables as carryover in garden amendments.

Appendices: Appendix A1: Pests associated with specific hosts in 2018.

Table A1. Common insects and diseases associated with urban/ornamental plant hosts submitted to the Schutter Diagnostic Lab, 2018. ***Bolded insects are the most common insects found for each host.***

Host Tree	Common Insects	Common Diseases
Apple	**Apple-and-thorn skeletonizer**	Fire blight
	Aphids; Plant lice	Cedar Apple Rust
	Blister mites	Cytospora Canker
	Codling moth	Powdery Mildew
	Leafhoppers	
	Oystershell scale	
	Tortricid leafrollers	
Arborvitae	**Spruce spider mites**	Kabatina/Phomopsis tip blight
Ash	Aphids; Plant lice	Anthracnose
	Ash flower gall mite	Cytospora Canker
	Ash plant bug	
	Banded ash borer	
	Leafcurl ash aphid	
	Psyllids (Black ash)	
	Spider mites	
Aspen/Cottonwood/Poplar/*Populus* spp.	**Aspen blotchminer**	Cytospora Canker
	Chaitophorus aphids	Marssonina leaf spot
	Cottonwood leaf beetle	Crown call
	Eriophyid mites	Bacterial tip/twig blight
	Leafhoppers	
	Poplar borer	
	Poplar leaf gall mite	
	Poplar twiggall fly	
	Spider mites	
Birch	**Birch leafminer**	Cytospora Canker
	Bronze birch borer	
	Tortricid leafrollers	
Boxelder	**Boxelder erineum mite**	
	Psyllids	
Cherry	Tortricid leafrollers	Black knot disease
	Black cherry aphid	Cytospora Canker
	Pear slugs/sawflies	Shot hole disease
Cotoneaster	**Oystershell scale**	Fire blight
Dogwood	Aphids; Plant lice	

Host Tree	Common Insects	Common Diseases
Douglas-Fir	**Douglas-fir beetle**	Sudden needle drop (SNEED)
	Western spruce budworm	Rhabdocline needle cast
Elm	Aphids; Plant lice	Cytospora Canker
	Elm leaf beetle	Wetwood
	European elm flea weevil	
	European elm scale	
Fir	**Douglas-fir beetle**	Cytospora Canker
	Tortricid moths	SNEED
	Western spruce budworm	
Hackberry	**Hackberry nipple gall maker**	
Honeylocust	**Honeylocust podgall midge**	Nectria canker
	Honeylocust spider mite	Cytospora Canker
Linden	Eriophyid mites	Cytospora Canker
		Nectria canker
Lilac	Eriophyid mites	Bacterial blight
	Root weevils (notching on leaves)	
Maple	**Cottony maple scale**	Anthracnose
Mountain ash	Eriophyid mites	Cytospora Canker
		Fire blight
		Nectria canker
Oak	*Callirhytis* oak gall wasp	Anthracnose
	Gall wasps	Oak leaf blister
	Rough oak bulletgall wasp	
Pine	*Cinara*, giant conifer aphids	Dothistroma needle blight
	Clearwing borers	Diplodia
	Coneworms; *Dioryctria* moths	Western gall rust
	***Phaenops* sp.**	
	Pine needle scale	
	Red turpentine beetle	
Plum/Pear/Prunus	Aphids; Plant lice	Bacterial blight
	Blister mites	Cytospora Canker
	Leafcurl plum aphid	Shot hole disease
	Plant bugs	
Spruce	Aphids; Plant lice	Rhizosphaera needle blight
	Cooley spruce gall adelgid	Sudden needle drop (SNEED)
	Leafhoppers	Cytospora Canker
	Pine needle scale	Stigmina needle blight
	Spruce bud scale	

Host Tree	Common Insects	Common Diseases
	Spruce spider mite	
	Western spruce budworm	
	White pine/sitka spruce weevil	
Viburnum	**Snowball aphid**	
	***Viburnum* erineum mites**	
Willow	**Cottonwood leaf beetle**	Willow black canker
	***Pterocomma* aphids**	Cytospora Canker
	Willow redgall sawfly	